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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/774,417	02/10/2004	Yoshiki Nishibayashi	50212-559	1031

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EXAMINER	
OLSEN, ALLAN W	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 07/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/774,417	NISHIBAYASHI ET AL.	
	Examiner	Art Unit	
	Allan Olsen	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 May 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 8-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 8-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 August 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 09/995,854.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3, 4, 8, 10 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by JP10-312735 (hereinafter, Saito) with reference to US 6,184,611, as an English language equivalent.

Saito teaches the reactive ion etching of a masked diamond substrate. Saito teaches the etchant may be pure O_2 or may be a mixture of O_2 and a lesser amount of CF_4. Specifically, Saito teaches that the ratio O_2: CF_4 may range from 100: 0 to 100:50 while applicant's claimed upper limit of 6 % F atoms corresponds to an O_2: CF_4 ratio of about 100:3.25. Saito teaches etching the diamond surface such the portion of diamond that is protected by the mask become cylindrical bulged portions (seed projections). Saito teaches the seed projections are "formed like substantially a circular cylinder" (i.e., having a side face with a substantially 90° angle of inclination) (column 4, lines 1-12; column 6, lines 32-39, 54-56). Claim 8 recites a limitation that requires the ratio of atomic oxygen to molecular oxygen to be higher than it would otherwise be in a pure oxygen plasma. The examiner notes it is a well-established principal that the ratio of atomic oxygen to molecular oxygen ($O:O_2$) increases when fluorine is added to an oxygen plasma (See, for example, IBM Technical Disclosure Bulletin NN8712128). Claim 10 recites a limitation pertaining to atomic and molecular

oxygen emission spectroscopy data. The recited limitations are inherent features of atomic and molecular oxygen emission spectra.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Saito.

The teachings of Saito as noted above are herein relied upon.

Saito does not teach using a parallel plate plasma reactor with a power of at least 0.45 W/cm^2 between the parallel plate electrodes.

It would have been obvious to use a parallel plate electrode apparatus because Saito teaches an RIE process which is a process generally associated with a parallel plate apparatus. With respect to the use of 0.45 W/cm^2, the examiner notes that plasma power is recognized as a cause effective variable and the selection of such parameters is considered to be obvious:

> "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Saito in view of IBM Technical Disclosure Bulletin NN8712128 (hereinafter, IBM).

The teachings of Saito as noted above are herein relied upon.

Saito does not teach adding N_2 to the O_2/CF_4 plasma.

IBM teaches adding N_2 to an O_2/CF_4 plasma.

It would have been obvious to one skilled in the art to add N_2 to the O_2/CF_4 plasma of Saito because Saito is etching a carbon material through a photoresist mask and IBM teaches that etching selectivity for a carbon material relative to a photoresist is increased when N_2 is added to an O_2/CF_4 plasma.

Response to Arguments

Applicant's arguments filed May 3, 2005 have been fully considered but they are not persuasive. Applicant argues their claimed etching technique includes using a fluorine concentration within a specific range and is designed to form a projection having a side face with an angle of inclination of at least 78 degrees. Applicant asserts that no such method is disclosed or suggested by Saito and that the method disclosed by Saito forms a projection having a conventional shape.

In response, the examiner notes that Saito teaches using an etchant with a fluorine atom concentration range that encompasses applicant's claimed range and Saito etches to form substantially circular cylinders. Therefore, Saito discloses a method by which the side face of an etched feature has an angle of inclination that is substantially 90° thereby meeting applicant's limitation of at least 78°C.

With respect to the interpretation of column 7 of Saito, lines 8 through 10, applicant questions the accuracy of the Examiner's position that Saito teaches an etching gas having a concentration such that the O_2: CF_4 ratio is 99.5:0.5. Applicant

states that this passage of Saito merely discloses that $(CF_4)/(CF_4+O_2)$ falls in a region up from 0 to 50% or a CF_4: O_2 ratio ranging from 100: 0 to 50: 50.

The examiner disagrees with applicant's interpretation. In fact, Saito discloses that the ratio of the volume fraction of CF_4 to the volume fraction of O_2 is greater than 0 but not greater than 0.5. In other words, Saito is disclosing:

$$[(CF_4)/(CF_4+O_2)] / [(O_2)/(CF_4+O_2)] \leq 0.5.$$

This expression reduces to $CF_4/O_2 \leq 0.5$. Therefore, if $CF_4 = 0.5$ then O_2 must be ≥ 1. Stated another way, the O_2: CF_4 ratio must be at least 1: 0.5 or 2:1, not 1:1 as argued by applicant. The examiner acknowledges that the passage at column 7, lines 6-8, does not explicitly teach an O_2: CF_4 ratio of 99.5: 0.5 but, it is noted that this ratio falls within the range taught by Saito and this ratio meets applicant's claim limitation.

Furthermore, it is noted that Saito discloses that the texture of the etched surface is a function of the fluorine atom concentration. In accord with applicant's specification, Saito discloses that a smooth surface may be obtained.

Regarding claim 8, which recites:

"wherein, in an emission spectrum of said mixed gas an intensity A of an emission peak caused by said oxygen atom and an intensity B of an emission peak caused by oxygen have an intensity ratio A/B which is greater than the intensity ratio A/B obtained from an emission of a plasma which is 100% oxygen",

The examiner states: "claim 8...requires the ratio of atomic oxygen to molecular oxygen to be higher [in an O_2/CF_4 plasma] than it would otherwise be in a pure oxygen plasma. The examiner notes it is a well-established principal that the ratio of atomic oxygen to molecular oxygen ($O:O_2$) increases when fluorine is added to an oxygen

plasma (See, for example, IBM Technical Disclosure Bulletin NN8712128)." Because of this fact, it follows that $O:O_2$ would greater in an O_2/ CF_4 mixture than it would be in a pure O_2 plasma and the relative amounts of each specie would be reflected in the ratio of emission intensity lines

In response, applicant argues, "neither the actual relied upon reference to Saito or mentioned IBM reference discloses or suggests the specific relationship between the intensity of emission peaks of oxygen atoms in the mixture gas and oxygen in the mixture gas with respect to the intensity ratio obtained from an emission of a plasma which is 100% oxygen."

The examiner does not understand the point being made with this argument. Is applicant arguing that the references do not teach that a ratio of emission peak intensities may be used as a measure of the amount of oxygen atoms and oxygen molecules?

Applicant also argues: "it is not apparent and the Examiner has not identified wherein the applied prior art discloses or suggests the relationship between the spectrum-analysis of the mixture gas employed and etching a diamond to form a specific shape.

In response, the examiner notes that the "limitation" of claim 8 that pertains to emission spectra is not a positively recited method step. This recitation of claim 8 merely addresses a relative condition of two plasma. The examiner has provided evidence in support of an argument that such conditions are inherent in the method of Saito.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441. The examiner can normally be reached on M-F 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Allan Olsen
Primary Examiner
Art Unit 1763